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5 Preschoolers Understand and Generate Pretend Actions Using Object Substitution

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Abstract

Pretend play is often considered to be an imaginative or creative activity. Yet past experimental research has focused on whether children imitate pretense, follow instructions to pretend, or understand others' pretense. Thus we cannot be sure that children's pretense is in fact novel, or whether they simply copy or follows others' instructions. This is the first experiment to show preschoolers generate their own novel object substitutions. In Study 1, 45 3- and 4-year-olds saw an experimenter use one object as another, accompanied by pretend or trying cues. Children differentiated between the experimenter's intentions by imitating the actions accompanied by pretend cues, and correcting the actions accompanied by trying cues. Additionally, when the experimenter made her intentions to pretend or try explicit, children produced significantly more novel object substitutions not modeled or verbally requested by the experimenter within a pretend context than within a trying context. Study 2 replicated these findings with 34 3-year-olds using a repeated-measures design. However, it found no relationship between children's copying or generation of object substitutions and: divergent thinking, inhibitory control, or pretense during free play.

Keywords: Pretend; Object substitution; Intention; Divergent thinking; Inhibitory control; Free play

Preschoolers Understand and Generate Pretend Actions Using Object Substitution

Pretend play is considered to be an imaginative or creative activity (e.g., Fehr & Russ, 2016; Harris & Kavanaugh, 1993; Hoffmann & Russ, 2016; Russ, Robins, & Christiano, 1999; Wallace & Russ, 2015; Wyman, Rakoczy, & Tomasello, 2009). Yet past experimental research focused on whether children imitate pretense, follow instructions to pretend, or understand others' pretense (e.g., Harris & Kavanaugh, 1993; Hopkins, Smith, Weisberg, & Lillard, 2016; Rakoczy, Tomasello, & Striano, 2004, 2006; Wyman, et al., 2009). Thus, we cannot be sure that children's pretense is in fact novel, or whether they simply copy or follows others' instructions. Some experimental work has attempted to capture children's novel pretense (Nielsen & Christie, 2008; Rakoczy, et al., 2004). However, we argue that what looked like novel pretense in these studies could be explained by deferred imitation. This is the first experiment to show preschoolers create their own novel object substitutions, without relying on deferred imitation.

Generating Object Substitutions

Pretend play differs from functional play as the actions performed during pretend play are technically incorrect (e.g., drinking from empty cup, talking to banana; Hoicka & Gattis, 2008; Hoicka, Jutsum, & Gattis, 2008; Hoicka & Martin, 2016). One form of pretend play, object substitution, requires temporarily suppressing the typical action for the object while performing an action that is typical for another object (e.g., pretending banana is phone; Tomasello, Striano, & Rochat, 1999).

Naturalistic research suggests children perform object substitution during free play from 2 years (e.g., Belsky & Most, 1981; McCune-Nicolich, 1981). However, these studies do not provide information on the content of their play. Additionally, it is difficult to determine whether children's object substitutions are generated by children themselves, or

whether they are copied from others (immediately after observation, or using deferred imitation; see Hoicka & Akhtar, 2012).

Experimental research suggests 2- to 3-year-olds perform object substitutions (e.g., Harris & Kavanaugh, 1993; Hopkins, et al., 2016; Wyman, et al., 2009). In a typical pretense experiment, the experimenter performed a pretend action (e.g., feeding a toy monkey a banana, in which the banana was a yellow block), after which the child was asked to perform the same action ("You give the monkey some banana"; Harris & Kavanaugh, 1993, experiment 2). Most children successfully produced object substitution (brought the yellow block to the monkey's mouth). Therefore, while demonstrating that 2-year-olds can imitate object substitutions, this does not tell us whether children can generate their own object substitutions.

Some studies found children generate object substitutions when the experimenter has not modeled the pretend action (e.g., Harris & Kavanaugh, 1993, experiments 3 and 4; Hopkins et al., 2016, study 1). However, in these studies, experimenters gave specific verbal prompts to do specific pretend actions. For example, Hopkins, et al. (2016) gave 3- to 5-year-olds objects that were different in shape and function to the target pretend object (e.g., using a ball to pretend to write). They then said, e.g., "Pretend that you are writing with this." The majority of children successfully performed pretend actions correctly, showing a model was not required. However, children did not invent their own object substitutions, but instead acted out those invented by the experimenter.

One study attempted to examine novel object substitutions directly. Nielsen and Christie (2008) asked 2- and 3-year-olds to play with a dollhouse and different toys: dolls, toy items (e.g., bed, couch, toy hamburger), and functional items (e.g., string, piece of cloth). After modeling three pretend play scenarios (e.g., using pen lid as toothbrush) children again played with the dollhouse. Children produced significantly more object substitutions after

modeling, and around half of the object substitutions were not modeled by the experimenter. However, the study does not give examples of the types of novel object substitutions performed. Therefore, if a typical object substitution was pretending some cloth was a blanket, children may have literally thought the cloth was a miniature blanket, and hence did not use object substitution. Furthermore, given that the pretend situation was likely quite familiar – playing with a dollhouse – those actions that looked novel to the coders may have been instances of deferred imitation (Hoicka & Akhtar, 2012). Our first goal was to determine whether 3-year-olds generate object substitutions without relying on (deferred) imitation.

Understanding Others' Intentions to Pretend

Understanding pretense involves understanding that while the person pretending is *intentionally* doing something *technically* wrong (Hoicka & Gattis, 2008; Hoicka, et al., 2008), the act is correct, and perhaps obligatory, in a shared imagined world (e.g., Wyman, et al., 2009). Rakoczy, et al. (2004, 2006) found 3-year-olds understood intentions to pretend during autosymbolic play (pretending with the original object, e.g., pretending to drink from empty cup). The experimenter either pretended to do an action, or tried but failed to do an action (e.g., writing with a pen that still had the cap on). Verbal and non-verbal cues indicated their intention to pretend (e.g., playful expression, sound effects), or their intention to perform the literal action (e.g., frustrated expression, stating surprise by saying, "Hmmm?") They found 3-year-olds (and to some extent 2-year-olds) imitated the pretend actions while correcting the trying actions (e.g., taking cap off the pen before coloring).

Since children copied actions marked as pretending, but corrected the same actions marked as trying, this suggests children distinguish intentions to pretend from mistakes (Rakoczy, et al., 2004, 2006). However, Hoicka and Akhtar (2011) argued that in these types of imitation tasks, children could be responding to the emotional cues conveyed by the

experimenters. In the studies by Rakoczy and colleagues (2004, 2006) pretend actions were accompanied by positive verbal and non-verbal cues, while trying actions were accompanied by negative verbal and non-verbal cues. Children could have imitated actions marked as pretending because they were associated with positive emotions, while avoiding actions marked as mistakes because they were associated with negative emotions.

Studies have demonstrated that 3-year-olds do likely understand the intention behind pretense. Three-year-olds go beyond imitating autosymbolic pretend scenarios, adding their own details, so are not just copying (Rakoczy, et al., 2004). However, it is also possible that since these were familiar pretense scenarios (eating, drinking) children used deferred imitation. More convincingly, 3-year-olds not only copy object substitutions, but also protest when others use the object for its original use (Wyman, et al., 2009), suggesting a deeper understanding of intentions. Our second goal was to investigate whether 3-year-olds distinguish intentions to pretend and try when object substitution is used. If children generate novel object substitutions that were not modelled in the pretend condition, and could not easily be produced using deferred imitation, this would suggest they understood the underlying intentions.

Study 1 investigated whether children (1) generate their own object substitutions without relying on (deferred) imitation or verbal prompts; and (2) distinguish intentions to pretend using object substitution from trying (but failing) to do a literal action. An experimenter showed pictures of two objects (e.g., glove, hat) and performed the action corresponding to one object with the other object (e.g., glove on head). Cues indicated intentions to pretend (e.g., smiling, sound effects), or try (e.g., grunting, saying “Whoops!”; Rakoczy, et al., 2004). We expected children to pretend after pretend cues, and perform correct actions after trying cues. Furthermore, we added extension trials (Hoicka & Akhtar, 2011) in which we showed two pictures, and gave children one of the objects pictured, but

did not show children what to do, nor did we verbally explain to them what to do. We expected children to continue to create their own acts of object substitution in the pretend condition, and use the objects literally in the trying condition. A further goal of Study 1 was to determine if explicit cues helped children distinguish intentions to pretend and try better than implicit cues (Rakoczy, et al., 2006).

In Study 2, we were interested in the mechanisms that might underlie generating object substitutions. We investigated whether divergent thinking and inhibitory control might underpin children's novel object substitutions. Pretend play in naturalistic settings correlates with divergent thinking in children 4 years and older (e.g., Delvecchio, Li, Pazzagli, Lis, & Mazzeschi, 2016; Fehr & Russ, 2016; Hoffman & Russ, 2016; Kaugars & Russ, 2009; Russ, et al., 1999; Wallace & Russ, 2015; Wyver & Spence, 1999). Similarly, inhibitory control is linked to structured pretend play using imitation and specific prompts in children 4 years and older (Kelly, Hammond, Dissanayake, & Ihsen, 2011), and 3-year-olds pretend more after engaging in inhibitory control tasks (Van Reet, 2015). We were interested to see if these findings replicate in 3-year-olds, who have lower levels of cognitive development (Welsh, Pennington, & Groissier, 1991), in both experimental, and free play settings. However, Hopkins and colleagues (2016) found links between object substitution during experiments and inhibitory control to be inconsistent across studies. We were also interested to discover whether children's performance on our experimental task was related to children's pretense during free play.

Study 1

Study 1 investigated whether children generate object substitutions without the help of an experimenter. Children's understanding of an experimenter's intentions to pretend using object substitution, or to try (and fail) to perform a literal action, was also investigated.

Explicit verbal instructions can aid children's pretense understanding. During a training phase, Rakoczy, et al. (2006) told one group of children explicitly that a person was "pretending to" or "trying to" do a certain action before doing the pretend or trying actions. Another group only received implicit cues that the person was pretending or trying (e.g., smiling, grunting, respectively), and a third group received no specific training. When 3-year-olds were asked whether an action was pretending or trying during test trials, they were more likely to give a correct response when they received the explicit training than when they received the implicit training or no training. This suggests that providing children with the direct association between the pretend action and the word "pretending" aids children in their understanding of the intentionality of these actions. To determine whether explicit verbal cues enhance children's object substitution, we compared the responses of children who received explicit and implicit cues versus implicit cues only.

Method

Participants. We ran a power analysis for our most conservative statistic, the Kruskal-Wallace test, which found we required 44 children with $\alpha = 0.05$, $\beta = 0.80$, and a large effect size, $w = 0.5$, (Faul, Erdfelder, Lang & Buchner, 2007). Forty-five 3- and 4-year-olds (19 males, mean age = 44.7 months; range = 38-51 months; SD = 3.8 months) were randomly assigned to one of four groups: Implicit Pretending (12), Implicit Trying (11), Explicit Pretending (11), and Explicit Trying (11). Children were of similar ages across conditions ($F(3,41) = .499$, $p = .685$) and boys and girls were equally distributed. Most of the children were British and Caucasian, and parents had attained a high school diploma (21%), an undergraduate degree (28%), or a postgraduate degree (51%). Participants were recruited through local nurseries, the Glasgow Science Centre, the Edinburgh Zoo, and through posters and playgroups. Ethical approval for the project, ""Pretense, behavioral cues and creativity in 3.5- and 4-year-olds" was obtained by the psychology department's ethics committee at the

University of XXXX. Parents signed consent forms for children to participate in studies. Children could choose not to participate.

Materials. Eighteen objects familiar to 3-year-olds were used. They were either household objects (e.g., toothbrush, phone) or objects that were frequently used in children's play (e.g., drum, ball; see Appendix A for a full list of objects). Pictures of the object were also used (see Appendix B). Two digital camcorders (SONY handycam) were used.

Design. The between-subjects independent variables were intention (pretend, try) and cues (explicit, implicit). The within-subjects independent variable was whether actions were modeled on the objects or not (model, extension). The dependent variable was whether children demonstrated object substitution or literal actions. Objects were presented in four orders, counterbalanced across children (see Appendix A).

The task consisted of four familiarization trials followed by eight test trials. The familiarization trials familiarized children with the task, and checked whether children imitated object substitutions and literal actions. The test trials were divided into two phases: a model phase (four trials), followed by an extension phase (four trials; based on Hoicka & Akhtar, 2011). The model phase allowed children to learn the rules of the game. The extension phase investigated whether children could generate object substitutions.

Procedure. After a short warm-up, the child (C) sat opposite the experimenter (E) at a small children's table. E placed a folder, containing all laminated A4 sheets with pictures, on the side of the table but within reach of C.

Familiarization trials. E took out one of two objects (toy car; tub with lid) and asked C to name the object. E then showed a picture in the folder. In the literal trials the picture was identical to the object, while in the object substitution trials the picture was different to the object (e.g., picture of a tub when the car was on the table). The familiarization part consisted of four trials (performing a literal action and an object substitution with both objects). The

literal action was always performed first, followed by the object substitution, although it varied whether the car or tub was used first. Actions were identical for all children, but the explicit cues were different for the Implicit and Explicit group (see Table 1 for an overview of the cues given).

Table 1.

Intentional verbal cues given in the familiarization trials, separately for the Explicit and the Implicit groups.

Implicit Group		Explicit Group	
Object substitution trials	Literal action trials	Object substitution trials	Literal action trials
Stating initial intention:			
"Let's use the [object] like this"	"Let's use the [object] like this"	"Let's pretend that the [object] is this"	"Let's try and use the [object] like this"
Reinforcing intention after action:			
No reinforcement	No reinforcement	"There!	"There!"
Prompting child to respond:			
"Now you try!"	"Now you try!"	"Now you try!"	"Now you try!"

In the Implicit group, E said, e.g., "Let's use the tub like this." She pointed at the tub with the lid when saying the object's name and pointed at a picture of the same tub when saying the word "this." E then opened the lid of the tub and closed it again, after which she gave the object to C and said, "Now you try!" During C's responses E always smiled and said "Alright" regardless of what the child did. Next, E showed the picture of a toy car and said,

"Now let's use the tub like this." E modeled 'driving' the tub around in circles, after which she gave the object to C again and said, "Now you try!" The same procedure was repeated using the toy car to perform literal or object substitution actions.

Test trials: Model phase. Children were again presented with an object but this time with two pictures instead of one. One of the pictures was identical to the object. The second was a picture of an object that was very different in function from the object (see Appendix B).

All children (in both Implicit and Explicit groups) received non-verbal intentional cues (Rakoczy, et al., 2004;). In the Pretend condition the implicit cues were: a positive facial expression, looking back and forth from the object to C, and producing sound effects. In the Trying condition the implicit cues were: a confused facial expression, looking continuously at the object, and stating confusion by saying, "Hmmm?"

Pretend condition. Children were presented with an object and two pictures, of which one was the same as the object on the table. E then performed a pretend action with the object, after which children were asked to act upon the object themselves. In the Explicit group, children were given explicit instructions to pretend, while in the Implicit group these cues were omitted (see Table 2 for an overview of the cues given to each group).

In the Implicit group, E, for example, presented the child with pictures of a ball and a cup and showed the child an actual ball which was identical to the picture. She then said, "Let's use the ball like this." When saying the word "this" she pointed at the picture of the cup (target picture). E then performed the action associated with that picture (i.e., bringing the ball to her mouth and tilting the object as if drinking from a cup), while making sound effects (slurping sounds; see Appendix C for the actions and sound effects for each object). E performed the action twice, waiting two seconds between the actions while looking at C with a positive facial expression. She then said, "You see? I was using it like this" while pointing

at the cup again. Then she gave the object to C and said, "Now you try!" E smiled and said, "Alright!" irrespective of the action C performed.

Table 2.

Intentional verbal cues given in the test trials, separately for the Explicit and Implicit groups.

Implicit Group		Explicit Group	
Pretend Condition	Trying Condition	Pretend Condition	Trying Condition
Stating initial intention:			
"Let's use the [object] like this"	"Let's use the [object] like this"	"Let's pretend that the [object] is this"	"Let's try and use the [object] like this"
Reinforcing intention after action:			
"You see? I was using it like this"	"Whoops! I was not using it like this"	"There! You see? I was pretending it was this"	"Whoops! I did it wrong. I was not using it like this"
Prompting child to respond (Model Phase):			
"Now you try!"	"Now you try!"	Now can you try and pretend?"	"Can you try and use it?"
Prompting child to respond (Extension Phase):			
"Now you try!"	"Now you try!"	Now can you try and pretend? What could you pretend it is?"	"Can you try and use it? How would you use it?"

Trying condition. This was identical to the Pretend condition, except the target picture to which E pointed was identical to the object in her hand. Crucially, E performed the same

action as in the Pretend condition (e.g., using the ball as a cup). However, she looked continuously at the object with a confused facial expression and said, "Hmmm?"

In the Implicit group, E said, for example, "Let's use the ball like this." When saying "this" she pointed at the picture of the ball. She then put the ball to her mouth and tilted it as if drinking from a cup. After performing this wrong (trying) action she pointed at the picture of the ball again and said, "Whoops! I was not using it like this. Now you try!" E again smiled and said, "Alright!" irrespective of the action C performed.

Test trials: Extension phase. In the extension phase, E did not model any actions. She again presented C with an object and two pictures (one identical to the object, the other very different in function to the object). To the children in the Implicit group she said, "Now you try!" To the children in the Explicit group, in the Pretend condition she said, "Now can you pretend? What could you pretend it is?" and in the Trying condition, "Now can you try and use it? How would you use it?" Please note E did not prompt C as to how to use the object, i.e., she did not point to either picture, or say, e.g., "Pretend it's a car." Instead, children had to infer they should use the object as the other pictured object.

Coding. All sessions were coded by the experimenter, who was also the first author. For each trial, it was coded whether the child performed an action corresponding to the actual object at hand (literal action), corresponding to the other pictured object (object substitution), or neither. A trained second observer, blind to the hypotheses of the study, independently coded 7 (16%) randomly chosen videos. Inter-rater agreement was very good, *Cohen's kappa* (k) = .82.

Results

Data for the percentage of trials children produced object substitutions (as a percentage of object substitution and literal actions combined) were positively skewed for the Model Phase of the Explicit Trying condition, and the Extension Phase of the Implicit Trying,

Implicit Pretense, and Explicit Trying conditions. However, data were negatively skewed for the Model Phase of the Implicit and Explicit Pretense conditions. Therefore, no transformations could normalize data, so we used Logit Mixed Effects Models (LMEM, see Hoicka & Akhtar, 2011 for more details). Models controlled for participant number and target objects. No effects of, or interactions with, age or gender were found. Children did not perform an object substitution or literal action for 6% of Model trials and 15% of Extension trials in the Implicit Pretend condition; 11% of Model trials and 11% of Extension trials in the Implicit Trying condition; and 2% of Extension trials in the Explicit Pretend condition. Figure 1 displays the mean percentage of trials in which children performed object substitutions (as a percentage of object substitution and literal actions combined), by Intention (Pretend, Trying), Cue (Implicit, Explicit), and Phase (Model, Extension). "Other" responses were not presented in this graph, which means the mean percentage of literal actions can be inferred from this graph by subtracting the mean numbers from 100.

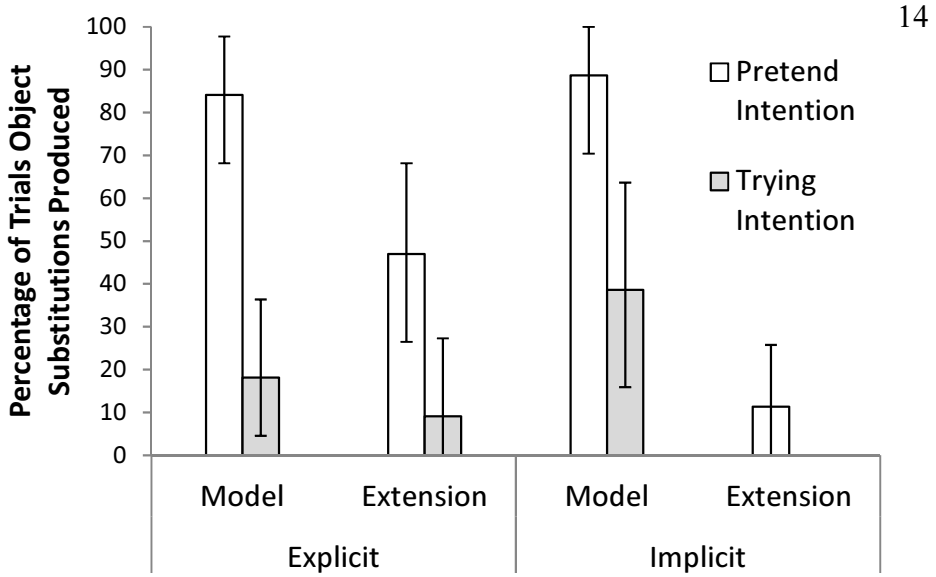

Figure 1. Percentage of trials children performed object substitutions (as a percentage of object substitution and literal actions combined), by Intention, Cue, and Phase in Study 1. Error bars represent 95% confidence intervals. Please note there is no bar for the Trying

Implicit Extension trials because the mean percentage of object substitution responses was 0 (children only produced literal actions).

The best model (*loglik* = -98.93, $N = 339$) was improved by Phase (Model, Extension), $\chi^2(1) = 122.18$, $p < .0001$; Intention (Pretend, Trying), $\chi^2(1) = 24.84$, $p < .0001$; and an interaction of Phase and Cue (Explicit, Implicit), $\chi^2(2) = 22.70$, $p < .0001$. Children produced significantly more object substitution than literal actions in the Pretend condition than the Trying condition (*Odds-Ratio, OR,* = 2136.24, $p < .0001$); when Explicit versus Implicit cues were used ($OR = 376.23$, $p = .0193$); and in the Model phase than the Extension phase ($OR = 53.21$, $p < .0001$). There was an interaction between Cue and Phase ($OR = 2733.67$, $p = .0045$). Children exposed to Explicit cues performed significantly more object substitutions in the Extension phase than children exposed to Implicit Cues.

We followed up with planned analyses examining the Model and Extension Phases separately within the Implicit and Explicit groups. In the Model phase, children were significantly more likely to perform object substitutions in the Pretend condition compared to the Trying condition. This was the case both when Explicit (*loglik* = -24.55, $N = 88$, $\chi^2(1) = 35.35$, $p < .0001$, $OR, = 8.46*e^{21}$, $p = .0328$), and Implicit cues were used (*loglik* = -25.05, $N = 84$, $\chi^2(1) = 17.16$, $p < .0001$, $OR, = 1.45*e^{7}$, $p = .0219$). In the Explicit group in the Extension phase children were marginally more likely to perform object substitutions in the Pretend condition than the Trying condition, (*loglik* = -31.66, $N = 87$, $\chi^2(1) = 7.91$, $p = .0049$, $OR, = 245.72$, $p = .0560$). In the Implicit group the best model (*loglik* = -5.48, $N = 80$, $\chi^2(1) = 0.003$, $p = .9549$) was not improved by condition. This suggests the explicit cues helped children to continue performing object substitutions when no model was presented.

We also coded whether children ever produced a novel object substitution. Zero out of 11 did so in the Implicit Trying condition; 1 out of 11 in the Explicit Trying condition; 2 out

of 12 in the Implicit Pretending condition; and 8 out of 11 in the Explicit Pretending condition. A Kruskal-Wallis test found a significant difference between conditions, $\chi^2(3) = 18.81$, $p < .001$. While chi-square analyses found a significant majority of children in the Implicit Trying, Explicit Trying, and Implicit Pretending conditions did not produce object substitution during the extension trials, all $\chi^2(1) > 5.33$, $p < .022$, there was no significant difference between the number of children who did and did not produce object substitution in the Explicit Pretending condition, $\chi^2(1) = 2.27$, $p = .132$.

Discussion

In the extension phase, when children had no model to respond to, nor did they receive specific prompts to pretend in a certain way, children were marginally more likely to generate their own object substitutions when the goal of the game was to pretend, but only after receiving explicit cues. Additionally, significantly more children generated novel object substitutions at some point in the explicit pretend condition compared to the other conditions. However, while most children in the explicit pretend condition generated novel object substitutions, this was not a significant majority. Therefore, it is not the case that 3-year-olds as a group are capable of generating novel object substitutions, even though, as a group, they are marginally better at generating novel object substitutions in a pretend context compared to a trying context.

During the model phase, children differentiated the intention to pretend (pretend condition) from the intention to do a literal action (trying condition). Children mostly corrected the mistakes an experimenter made, while imitating the object substitutions. However, children did not need explicit instructions to understand how to respond to the experimenter's behavior in the model phase.

By extending the pretend or genuine actions in the Extension phase we argue that the child needs to understand the higher-level strategy to pretend (use object A as object B) or try

to perform the genuine action (use object A as object A). The finding that children in the Explicit group found it easier to extend the appropriate action provides further evidence that it is important for the child to understand this higher-order intention before they can act appropriately, and that an explicit prompt to "pretend" or "try and use the object" aids in this understanding.

Study 2

Object substitution requires the ability to think of an alternative action or object to represent (divergent thinking), while at the same time inhibiting the original action one would do on or with that object (inhibitory control). Pretend play in naturalistic settings correlates with divergent thinking (e.g., Delvecchio, et al., 2016; Fehr & Russ, 2016; Hoffman & Russ, 2016; Kaugars & Russ, 2009; Russ, et al., 1999; Wallace & Russ, 2015; Wyver & Spence, 1999). Dansky (1980) also found that children who pretended regularly during free play produced more responses in a verbal divergent thinking task, but only when they engaged in free play immediately prior to the task. This relationship was not found when children engaged in an imitation or convergent problem-solving task. This suggests that the relationship between pretend play and divergent thinking may not be as straightforward as some argue, and other factors should be taken into account as well. Inhibitory control sometimes correlates to children's pretend play (Kelly, et al., 2011), but sometimes not (Hopkins, et al., 2016). Study 2 sought to investigate whether divergent thinking and inhibitory control correlate with children's novel object substitution in an experimental setting.

Most studies on pretend play focus either on investigating specific abilities using experimental designs (e.g., Hopkins, et al., 2016; Rakoczy, et al., 2004, 2006; Wyman, et al., 2009) or detecting overall developmental patterns of pretend play using naturalistic settings (e.g., Belsky & Most, 1981; Howes & Matheson, 1992; Lillard & Witherington, 2004; Wyver

& Spence, 1999), but rarely have these two designs been assessed together. Kelly, et al. (2011) found spontaneous pretend play of 4- to 7-year-olds during free play correlated with scores on the Test of Pretend Play (Lewis & Boucher, 1997), which involves copying and carrying out verbally instructed pretend actions. Nakamichi (2015) found 18-month-olds' understanding of pretending during free play strongly correlated with Harris and Kavanaugh's (1993) Teddy task at 24 months. Study 2 sought to investigate whether the results from our pretend experiment were indicative of children's pretend play behavior in a naturalistic setting.

Method

Participants. We ran a power analysis for our most conservative test, the Wilcoxon Signed-ranks test, which found we required 32 children with $\alpha = 0.05$, $\beta = 0.80$, and a large effect size, $w = 0.5$, (Faul, et al., 2007). Thirty-four 3-year-olds (19 males, mean age = 42 months; range = 36 - 48 months; SD = 3.8 months) participated. Most children were British and Caucasian, and parents had attained a high school diploma (22%), an undergraduate degree (33%), or a postgraduate degree (44%). Participants were recruited as in Study 1. Ethical approval and consent was the same as Study 1.

Materials, Procedure, and Coding.

Pretend experiment. The materials, procedure and coding were identical to the Explicit condition of Study 1, except that children participated in both the Pretend and Trying conditions on different days (see design). Seven participants (20%) were coded for the Pretend condition by a second coder blind to the hypotheses of the study. Another seven (20%) were coded for the Trying condition. Agreement was very good, $k = 0.91$.

Unusual Box Test (UBT, divergent thinking). The materials and procedure used for the UBT are described in Bijvoet-van den Berg and Hoicka (2014). We chose to use a physical measure of divergent thinking as the pretend tasks were also physical. There are

only two physical divergent thinking tests validated for 3-year-olds: the Thinking Creatively in Action and Movement test (TCAM; Torrance, 1981), and the UBT. We chose not to use the TCAM as some of the trials involve pretending, which would mean we would be correlating pretending with pretending. The UBT is physical, but does not involve pretending. The UBT has good test-retest reliability in children as young as 1 year (Bijvoet-van den Berg & Hoicka, 2014; Hoicka, et al., 2016). It has also been validated against the TCAM and the verbal Instances subtest of the Wallach and Kogan tests of creativity (Wallach & Kogan, 1965). The child was presented with a wooden box with an open top containing several features (e.g., rings, stairs, hole), which was placed on a turn table. E showed all the features on the box while turning the box. After C was given a chance to turn the box, s/he received one of five novel objects (egg holder, spatula, feather roller, Kong rubber toy, hook) to play with together with the box for 90 seconds each. E sat on the side and interacted minimally with C.

Divergent thinking scores were calculated by counting the number of different actions C performed for all trials combined (5 x 90 seconds). Actions were coded on two features: what type of action was performed (e.g., hit, place) and what part of the box was used during the action (e.g., stairs, rings). Seven participants (20%) were coded by a second coder blind to the hypotheses of the study. Agreement was good, *Intraclass correlation* = 0.76, $p = .027$.

Day-Night task (inhibitory control). Inhibitory control was assessed using the Day-Night task (Gerstadt, Hong, & Diamond, 1994). Fourteen pictures were used. Half showed a yellow sun on a light blue background. The other half showed a white moon and four stars on a black background. E started with two practice trials in which she explained that when presented with a moon card C had to respond with the word “day.” When presented with a sun card C had to respond with the word “night.” During two practice trials, E presented a sun and a moon card. If C responded incorrectly, E explained the rules again and gave

another two practice trials. After that, 14 test trials (seven sun cards and seven moon cards) were presented to C in a pseudorandom order (see Gerstadt, et al., 1994). E always asked, "What do you say for this one?" but no other feedback was given. C's answers were written down by E during the task, and afterwards coded for being correct or incorrect. A correct answer was when C said "day" when presented with a moon card, and "night" when presented with a sun card. Any other responses were counted as incorrect.

Free play. E told C that she was interested in seeing how well s/he could play on his/her own. This was to inhibit C's desire to play together with E. E sat approximately two meters away and acted busy. Thirty-six objects were used, divided equally over three 5-minute sessions. Half of the objects were of indiscriminate shape and function whereas the other half were functionally specific. Figure 2 displays the toys used for each session. The toys were presented to C on a plastic tray (30x40cm). C was given up to 5 minutes to play with the toys, with a minimum play time of 2 minutes. If C clearly stated after 2 minutes that s/he was finished playing with the toys, E replaced the toys with new ones.

C's behavior during free play was coded using Observer XT. A hierarchical system was used, based on the Exploratory Behavior Scale by Van Schijndel, Franse, and Raijmakers (2010). The lowest behavior level was No Pretense. The next level was Autosymbolic Pretense, in which C used the object for its original purpose in a pretend-like fashion (e.g., pretending to pour tea from teapot). The third level was Object Substitution Pretense in which C pretended an object was something else (e.g., pretending a stick was a spoon). Appendix D gives a description of the levels, and examples of behaviors. Behavior was coded during 5 second intervals. The highest level of behavior that C demonstrated per time interval was coded (Van Schijndel, et al., 2010). For example, when within one interval C did both autosymbolic pretending, and no pretending, the interval was coded as autosymbolic pretending. A maximum number of 180 intervals were coded (60 intervals x 3 sessions). The

frequency of intervals that children spent in autosymbolic pretend play and object substitution were used for analyses[1]. Six participants (18%) were coded by a second coder blind to the hypotheses of the study. Agreement was very good, $k = 0.84$.

A) Pretend Session

B) Functional Session

C) Combined Session

Figure 2. Toys used for the three sessions of free play. A) Pretend session – Functionally specific toys (FST): stuffed toy animal dog and rabbit, teapot with lid, cup and saucer. Indiscriminate function toys (IFT): three sponges of different shapes, three closed-off tubes with ridges. B) Functional session - FST: xylophone, hammer, shape sorter with lid, two

[1] Not all children completed 180 intervals (N = 10). When children clearly stated they were finished playing, the session was stopped. Initially, we controlled for the variance in number of intervals by dividing the frequency of behavior by the total number of play intervals. However, no differences in analyses were found when using this measure. Therefore, for simplicity, we continued using frequency instead of relative frequencies.

blocks (heart and flower shape) that fit in the shape sorter. IFT: two round shaped pegs and a block to place them in, three Duplo blocks. C) Combined session – FST: bucket, shovel, fish-shaped sand shaper, two miniature plastic dolls (a lady and a little girl). IFT: shoe lace, three plastic cotton reels, three wooden blocks of different shapes (rectangle, round and rainbow shape).

Design. This study was a within-subjects design in which children completed all tasks. For the 21 children who participated in their nursery, the tasks were administered in four sessions (the Day-Night task was administered together with one of the other tasks). The other 13 children completed the tasks in two sessions, for the convenience of the parents. Testing order was counterbalanced. The Pretend condition was deliberately not combined with the free play session or the Trying condition, to avoid the child's behavior in the pretend condition influencing his/her behavior on the other tasks or vice versa.

Children were never presented with the same objects in the Pretend and Trying conditions. For the UBT, the order of objects given to children was counterbalanced, following Bijvoet-van den Berg and Hoicka (2014). For the free play session, the toys were given in three possible orders (Order 1: Pretend (P) – Functional (F) – Combined (C); Order 2: F – C – P; Order 3: C – P – F), which were counterbalanced across children.

Results

Data for the percentage of trials children produced object substitutions (as a percentage of object substitution and literal actions combined) were positively skewed for the Extension phase of the Trying condition, but negatively skewed for the Model phase of the Pretense condition. Therefore, no transformations could normalize data, so we used LMEM. Children did not perform an object substitution or literal action for 8% of Model trials and 3% of Extension trials in the Pretense condition; and 6% of Model trials and 4% of Extension

trials in the Trying condition. Figure 3 displays the percentage of trials for which children performed object substitutions (as a percentage of object substitution and literal actions combined), by Intention (Pretend, Trying), and Phase (Model, Extension).

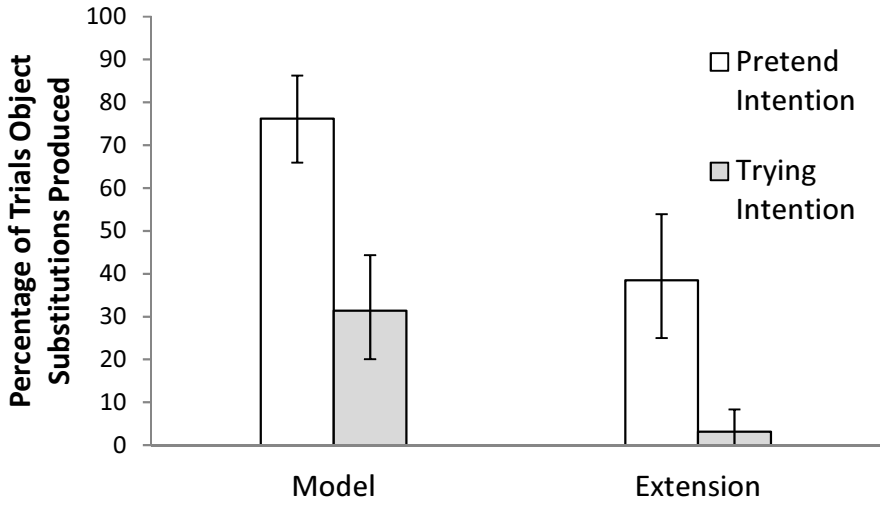

Figure 3. Percentage of trials children performed object substitutions (as a percentage of object substitution and literal actions combined), by Intention and Phase, in Study 2. Bars represent 95% confidence intervals.

The best model (*loglik* = -216.29, $N = 514$) was improved by Intention (Pretend, Trying), $\chi^2(1) = 114.35$, $p < .0001$; and Phase (Model, Extension) $\chi^2(1) = 102.66$, $p < .0001$. Children were significantly more likely to perform object substitutions than literal actions in the Pretend versus Trying condition ($OR = 27.31$, $p < .0001$); and in the Model versus Extension phase ($OR = 16.73$, $p < .0001$).

We followed up with planned analyses examining the Model and Extension phases separately. The best model for the Model phase (*loglik* = -134.28, $N = 262$, $\chi^2(1) = 73.39$, $p < .0001$) found children were significantly more likely to perform object substitutions than literal actions in the Pretend than Trying condition ($OR = 20.07$, $p < .0001$). The best model for the Extension phase (*loglik* = -74.59, $N = 252$, $\chi^2(1) = 84.86$, $p < .0001$) found children

were significantly more likely to perform object substitution than literal actions in the Pretend than Trying condition (OR = 477.47, $p < .0001$).

We also coded whether children ever produced a novel object substitution within each condition. Two out of 34 children did so in the Trying condition, and 20 out of 34 in the Pretend condition. A Wilcoxon Signed-Ranks test found a significant difference between conditions, $\chi^2(2) = 4.24$, $p < .001$. While chi-square analyses found a significant majority of children in the Trying condition did not pretend during the Extension phase, $\chi^2(1) = 26.47$, $p < .001$, there was no significant difference between the number of children who did and did not pretend in the Pretend condition, $\chi^2(1) = 1.06$, $p = .303$.

Divergent thinking, inhibitory control, and free play. We ran correlations between the number of object substitutions in the modeling and extension phases of the Pretend condition (separately) and: divergent thinking, inhibitory control, object substitution during free play, autosymbolic play during free play, and age. Table 3 shows the means, ranges, and confidence intervals of the variables (age is in the participant section). One child did not complete the free play task, and another child did not complete the inhibitory control task.

Table 3.

Descriptive statistics for the number of object substitutions performed in the model and extension phases of the experiment; divergent thinking scores; inhibitory control scores; and the number of free play intervals involving object substitution and autosymbolic pretense.

	N	Mean	Range	Confidence Interval
Experiment: Model Trials	34	2.97	0-4	2.54-3.40
Experiment: Extension Trials	34	1.41	0-4	0.87-1.95
Divergent Thinking	34	26.03	16-38	23.98-28.08
Inhibitory Control	33	8.67	1-16	6.77-10.57

Free Play: Object Substitution	33	2.52	0-9	1.47-3.56
Free Play: Autosymbolic Pretense	33	12.64	0-48	9.08-16.20

Since the number of object substitutions in the Model phase was negatively skewed, and the number of object substitutions in the extension phase, as well as the number of autosymbolic pretend intervals in free play, were positively skewed, Spearman's Rho was used for correlations with these variables. The remaining correlations used Pearson's *r*. Table 4 shows positive relationships between object substitution during the Model and Extension phases of the experiment ($p = .009$), object substitution during free play and divergent thinking ($p = .030$), and divergent thinking and age ($p = .007$). We followed up with a partial correlation between object substitution during free play and divergent thinking, controlling for age, which was significant ($r = .403$, $p = .022$).

Table 4.

Correlations between object substitution during the modeling and extension phases of the experiment, divergent thinking, inhibitory control, object substitution and autosymbolic pretense during free play, and age. Spearman's Rho is used for all correlations with object substitution during both modeling and extension phases of the experiment and autosymbolic pretense during free play. Pearson's r was used for the remaining analyses.

	Experiment: Extension Trials	Divergent Thinking	Inhibitory Control	Free Play: Object Substitution	Free Play: Autosymbolic Pretense	Age
Experiment: Modeling Trials	.441** $N = 34$	-.014 $N = 34$	-.195 $N = 33$	-.084 $N = 33$	.000 $N = 33$	.154 $N = 34$

Experiment: Extension Trials	.049 *N* = 34	.048 *N* = 33	-.138 *N* = 33	-.127 *N* = 33	.200 *N* = 34
Divergent Thinking		-.197 *N* = 33	.378* *N* = 33	.028 *N* = 33	.451** *N* = 34
Inhibitory Control			-.060 *N* = 32	.098 *N* = 32	-.058 *N* = 33
Free Play: Object Substitution				.211 *N* = 33	.052 *N* = 33
Free Play: Autosymbolic Pretense					-.293 *N* = 33

*p < .05, **p < .01

Discussion

Study 2 replicated the results for the explicit conditions in Study 1 using a repeated-measures design. Children generated significantly more novel object substitutions when the goal was to pretend. Children also distinguished the experimenter's intentions between the pretend and trying conditions. Additionally, while most children generated novel object substitutions in the pretend condition, this did not reach a significant majority.

Neither children's copied nor novel object substitutions during the pretense experiment were related to divergent thinking, inhibitory control, the frequency of object substitution during free play, the frequency of autosymbolic play during free play, nor age, although they did correlate with each other. These results contradict previous literature

reporting a relationship between pretend play and divergent thinking (e.g., Delvecchio, et al., 2016; Fehr & Russ, 2016; Hoffman & Russ, 2016; Kaugars & Russ, 2009; Russ, et al., 1999; Wallace & Russ, 2015; Wyver & Spence, 1999), and between pretend play and inhibitory control (Kelly, et al., 2011). Instead, our results are consistent with Dansky's (1980) finding that pretend play and divergent thinking are not necessarily related, and with Hopkins' and colleagues' (2016) findings that inhibitory control and object substitution are not necessarily related.

Although we did use a non-verbal measure of divergent thinking instead of a verbal measure, it is unlikely this could explain why no relationship was found between responses in the pretend experiment and divergent thinking. Bijvoet-van den Berg and Hoicka (2014) found high correlations between the UBT and verbal measures of divergent thinking, which suggests that they measure similar constructs. Furthermore, one could argue that a non-verbal, action-based, measure of divergent thinking would be better comparable to the action-based pretend experiment and therefore, if any relationship would be found it would be more likely to be significant using the non-verbal measure.

It is interesting to note that the correlation between object substitution in the experimental and free play studies were not correlated. This indicates that children's inability to generate object substitutions in an experimental settings does not necessarily mean that they do not show object substitution in a free play setting, or vice versa.

General Discussion

Generating Novel Object Substitutions

Our studies show children generate object substitutions without the use of a model or specific prompts, and with objects different in function to the target pretend object. Children were significantly more likely to do so within an explicit pretend context, rather than a trying context, or an implicit pretend context. The results from both studies dismiss the possibility

that children's pretend responses can only be caused by imitating the experimenter or through verbally prompting a specific pretend action (e.g., Harris & Kavanaugh, 1993; Hopkins, et al., 2016; Rakoczy, et al., 2004; Rakoczy & Tomasello, 2006; Wyman, et al., 2009). This research converges with findings that young children can create their own novel iconic gestures (Behne, Carpenter, & Tomasello, 2014); create their own novel jokes (Hoicka & Akhtar, 2011); and generate their own novel actions (Bijvoet-van den Berg & Hoicka, 2014; Hoicka, et al., 2016; Hoicka, et al., 2017). Therefore, this research strengthens the notion that children are not only social learners, but can also think for themselves.

However, some caution should be taken as while most children in the explicit pretend conditions in both studies produced novel acts of object substitution, this was not a significant majority, suggesting many 3-year-olds still struggle with this ability. Interestingly, this may be consistent with past research. While Rakoczy, et al. (2004) found 3-year-olds were significantly more likely to extend autosymbolic pretense acts within a pretend intentional context compared to a trying context, they only did so around 50% of the time, and no information was given about the number of children who ever extended the pretend acts, making it unclear whether most 3-year-olds can do so. Similarly, while Hoicka and Akhtar (2011) found 2- and 3-year-olds were significantly more likely to invent jokes within a humorous intentional context compared to a sincere context, they only did so around 40-50% of the time, and no information was given about the number of children who ever invented jokes. Finally, while Behne, et al., (2014) found 2-year-olds were significantly more likely to generate novel iconic gestures in a communicative versus non-communicative context, they only did so around 35% of the time. Furthermore, while 58% of children ever created a novel iconic gesture, no chi-square analysis was done, and our own analysis (14/24 children) found it would be non-significant. Therefore, while children as a group produce novel acts in appropriate contexts significantly more often than they do in control contexts,

these findings suggest that most children, as a group, may not actually be able to generate novel non-literal acts. This is striking as one of the key tenets of pretend play is that it supposed to be a creative act (e.g., Fehr & Russ, 2016; Harris & Kavanaugh, 1993; Hoffmann & Russ, 2016; Russ, et al., 1999; Wallace & Russ, 2015; Wyman, et al., 2009). Instead, ours and other research suggests that pretend play may be primarily imitative in nature, at least for children 3 years and under, which fits well with research suggesting pretend play has a normative function (Hoicka & Martin, 2016; Rakoczy, 2008; Wyman, et al., 2009). This also suggests that while children start to use object substitution from 2 years (Belsky & Most, 1981; Harris & Kavanaugh, 1993; McCune-Nicolich, 1981), many 3-year-olds may still not be able to cognitively plan and enact the representation of one object as another. Study 2 shows this is not due to problems with divergent thinking or inhibitory control, but it could perhaps be linked to general planning skills or cognitive flexibility, which are still developing in 3-year-olds (Blakey & Carroll, 2018; Welsh, et al., 1991). Future research should consider these discrepancies in more detail, and consider the individual differences which drive these results. It should also examine performance in 4-year-olds, for whom executive functions are more developed.

When children were shown pretend rather than trying actions in the model phase, they were more likely to generate object substitutions in the extension phase. This is congruent with previous findings that children produce more pretend actions after seeing a pretend model (e.g., Fiese, 1990; Nielsen & Christie, 2008; Rakoczy, et al., 2006). In the introduction we mentioned that children may have used deferred imitation to guide their object substitution. In our experiment, deferred imitation is an improbable explanation since the objects in the extension phase were unrelated to the objects in the model phase; nor were they acts of object substitution children were likely to have seen before.

Both studies found children performed more object substitutions during the model phase than the extension phase. One possibility is that imitating object substitutions requires fewer cognitive skills than generating object substitutions. However, our study found that generating object substitutions did not relate to either inhibitory control or divergent thinking, so if this is the case, other cognitive skills must be at play, e.g., planning (Harris, 1993). Additionally, pretend play is often a social encounter (Shim, Herwig, & Shelly, 2001). Therefore, children might find it easier to affiliate with someone else engaged in pretense than generating these actions without a partner.

Intentions to Produce Object Substitution

Both naturalistic and experimental research has focused on whether children understand that, while pretending, adults intentionally perform wrong actions. In naturalistic settings, parents gave specific cues to indicate they were pretending (e.g., exaggerated movements, sound effects, reinforcing actions through language and repetition, increased infant-directed speech; Hoicka, 2016; Hoicka & Butcher, 2016; Lillard & Witherington, 2004, Nakamichi, 2015). When experimenters used similar cues, 3-year-olds distinguished autosymbolic pretend actions (e.g., writing with capped pen) and trying actions (when the experimenter intended to do a correct action; Rakoczy, et al., 2004). Our studies indicate 3-year-olds understand the intentions behind object substitutions as well, and that they differentiate these intentions from mistakes. Our results resemble the findings by Rakoczy, et al., (2004), suggesting children are good at understanding the intentions behind both autosymbolic play and object substitution. The extra difficulty of having to suppress the initial motor response, and generate an entirely different motor response during object substitution, does not expunge children's ability to understand the intentions behind pretense.

One possibility is that instead of children understanding the intentions to pretend, they instead responded to emotional cues (Hoicka & Akhtar, 2011). In the pretend condition, the

experimenter was positive, and in the trying condition, the experimenter was negative. Therefore, children may have copied actions marked with positive emotion, and avoided actions marked with negative emotions. However, given that children in our study also generated significantly more novel pretend actions in the pretend intentional context, this suggests children really did understand the intentional context. This is because children could not simply imitate in the extension trials, and instead had to generate novel pretense, demonstrating an underlying understanding of pretense. Additionally, they only did so in the explicit condition, suggesting the word "pretend" was important, not just the emotional cues. However, given that most children, but not a significant majority of children, produced novel object substitutions in the explicit pretend condition, it is possible that some children relied on an emotion-based rule of imitating/avoiding, while others understood the underlying intentions.

Experimental vs. Naturalistic Settings

Our results indicate that children's imitation and generation of object substitution in an experimental setting does not relate to pretense during free play. This contradicts findings by Kelly, et al. (2011) who found a positive relationship between experimental and naturalistic pretend play. However, in the Kelly, et al. study the free play session always followed the experimental task. Therefore, children may have been primed to continue pretending in the free play session, leading to a correlation due to order effects. In contrast, if children had done the free play task first, perhaps they would not have been primed to pretend, leading to a null result. In contrast, our experimental and free play tasks were run on different days in counterbalanced order.

Our results also contradict the findings that the more toddlers smiled and pretended (combined) at 18 months, the higher they scored on a pretend task at 24 months that involved following instructions to pretend (Nakamichi, 2015). However, it is possible that toddlers

imitated pretending at 18 months (as free play involved mothers being instructed to perform specific pretend actions), and that imitating pretense at 18 months related to following verbal instructions at 24 months. In contrast, while the modeling phase of our experiment involved imitation, the extension phase relied completely on novel object substitution, while our free play study offered no modeling or instruction. Therefore, perhaps socially learned pretending in free play and experimental settings correlate, but novel pretending does not.

What we see in young children's everyday behavior may not match our conceptualization of pretending as being imaginative and boundless. While our experiments and other studies (e.g., Hopkins et al., 2016) show 3-year-olds *can* produce object substitutions which are very different in function to the original object, it may not be that object substitution in everyday life is performed this way. Our results suggest we should be careful to interpret findings from experiments as being reflective of how children would respond in a naturalistic setting. Future studies should consider the possible discrepancy between experimental and naturalistic behavior. More research is needed in which experimental and naturalistic behaviors are directly compared.

Object Substitution and Cognition

Divergent thinking had no relation with how well children either copied or generated object substitution during the experiment in Study 2. However, we did find a moderately strong positive correlation between divergent thinking and object substitution during free play, extending previous findings which found this relationship from 4 years onwards (e.g., Delvecchio, et al., 2016; Fehr & Russ, 2016; Hoffman & Russ, 2016; Kaugars & Russ, 2009; Russ, et al., 1999; Wallace & Russ, 2015; Wyver & Spence, 1999). One possibility is that long term memory is linked to both divergent thinking and deferred imitation (Gilhooly, Fioratou, Anthony, & Wynn, 2007; Meltzoff & Moore, 1994). Therefore, children with better

long term memory may have use deferred imitation to generate more object substitutions during free play, and also to generate more ideas for the divergent thinking test.

Inhibitory control had no relationship with children's ability to imitate or generate object substitutions, either in experimental or naturalistic settings. This contradicts previous findings that inhibitory control is related to children's symbolic play skills (Kelly, et al., 2011), and instead confirms that the link between inhibitory control and object substitution is tenuous (Hopkins, et al., 2016). One possible explanation is that in a cooperative pretend setting, where the adult models the pretend action, children do not need to inhibit the original action associated with the object, but instead enter a mode where they can by-pass their own knowledge of the object, and use it in a collective way as a pretend object. However, it is unclear why inhibitory control would still not correlate with children's own object substitutions as these would need to be figured out by children on their own.

Conclusion

The results suggest 3-year-olds are able to create novel pretend actions. They are more likely to generate their own object substitutions within a pretend than trying context. They do not require a model or prompts for specific pretend actions from an experimenter to do so. Explicit instructions that emphasize the goal to pretend further aids children's ability to generate object substitution. Additionally, children differentiate between an experimenter's intentions to pretend or to try (but fail) to perform a literal action. However, children's ability to copy or generate object substitutions during the experiment was not related to their divergent thinking skills, inhibitory control, nor pretense during free play. Future studies focused on experimentally testing pretend play abilities in children should consider how these may relate to pretense in naturalistic settings. Finally, while most children in the explicit pretend condition generated novel object substitutions, it was not a significant majority, suggesting individual differences still exist in this age range.

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Appendix A

Order of object pairs used in the Test Phase of the pretend experiments in Studies 1 and 2.

Order 1

Phase	Object Presented	Other Picture
Model	Ball	Cup
	Piano	Camera
	Hat	Glove
	Toothbrush	Whistle
Extension	Hammer	Brush
	Shaker	Pen
	Soap	Glasses
	Phone	Drum

Order 2

Phase	Object Presented	Other Picture
Model	Hammer	Brush
	Shaker	Pen
	Soap	Glasses
	Phone	Drum
Extension	Ball	Cup
	Piano	Camera
	Hat	Glove
	Toothbrush	Whistle

Order 3

Phase	**Object Presented**	**Other Picture**
Model	Cup	Ball
	Camera	Piano
	Glove	Hat
	Whistle	Toothbrush
Extension	Brush	Hammer
	Pen	Shaker
	Glasses	Soap
	Drum	Phone

Order 4

Phase	**Object Presented**	**Other picture**
Model	Brush	Hammer
	Pen	Shaker
	Glasses	Soap
	Drum	Phone
Extension	Cup	Ball
	Camera	Piano
	Glove	Hat
	Whistle	Toothbrush

1

2

Appendix B

Pictures of objects used in the pretend experiments in Studies 1 and 2

Familiarization Phase:


Test Phase:















Appendix C

Actions performed on each object, and sounds effects made in the Pretend Condition

Object Presented	**Target Object**	**Action**	**Sound Effects Pretending**
Ball	Cup	Holding the ball in a way you would normally hold a cup and bringing the ball to the mouth, as though to drink from it.	Slurping, as if drinking from a cup
Cup	Ball	Taking the cup in two hands and holding it a bit above the table, in a way you would normally hold a ball before bouncing it. Then bouncing the cup on the table.	"Boing Boing" – as if bouncing a ball
Piano	Camera	Holding the piano with one hand on each side, in a way you would normally hold a camera. Bringing the piano to the eye, as if looking through the viewfinder. Then pressing with one finger on top of the piano, as if taking a picture.	"Click click"
Camera	Piano	Placing the camera flat on the table, then moving hands from left to right over the camera, while moving fingers as if playing piano.	Singing melody as if playing a tune
Hat	Glove	Holding the hat in one hand, while holding the other hand above the table with fingers spread. Sliding the hat over the hand from fingers to wrist, then letting go of the hat and looking at the hat on the hand.	"Ohhhh" – as if admiring how pretty the glove is

Glove	Hat	Picking up the glove with two hands, in a way you would normally hold a hat. Placing the glove on top of the head, and holding hands to the side as if showing off the hat	"Ohhhh" – as if admiring how pretty the hat is
Toothbrush	Whistle	Picking up the toothbrush with two hands, in a way you would normally hold a whistle. Bringing the toothbrush to the mouth and moving fingers as if playing.	Singing melody as if playing a tune
Whistle	Toothbrush	Bringing the whistle a short distance in front of the mouth in a way you would normally hold a toothbrush. Opening mouth so that teeth are visible, then moving hand from left to right in front of teeth.	"Shhh shhh shhh" – like the sound of the toothbrush on the teeth
Hammer	Brush	Holding the hammer in one hand, in a way you would normally hold a hair brush. Bringing the hammer to the hair and moving hand up and down over the hair, as if brushing it.	"Shh shh" – as the sound a hair brush makes when going through hair
Brush	Hammer	Holding the brush with the bristles to the side, in a way you would normally hold a hammer. Banging the brush three times on the table.	The banging sound of the brush against the table

Shaker	Pen	Holding the shaker in a way you would normally hold a pen. Making movements with the end of the shaker on the table as if writing.	"Ohhhh" – as if admiring what was written
Pen	Shaker	Holding the pen with writing end firmly in one hand in a way you would normally hold a shaker. Shaking pen quickly on one side of the body, then moving hand to other side and making another shaking movement.	"Cha-cha" – as the sound a shaker makes when shaking it
Soap	Glasses	Picking up the soap with one hand on each side. Bringing the soap to face on the top of the nose, covering the eyes. Moves head from left to right and back as if looking through glasses.	"Ohhhh" – as if admiring the view through the glasses
Glasses	Soap	Holding the glasses (closed) in one hand. Moving other hand over the glasses, then placing it in the other hand and moving the spare hand over the glasses, as if washing hands with soap.	"Lalala" – as if enjoying washing hands
Phone	Drum	Placing the phone flat on the table, then hitting phone in turns with both hand on the phone.	Banging sound of the hands on the phone
Drum	Phone	Taking the drum in one hand by the rim. With the other hand, using the index finger to hit the drum as if pressing buttons on a phone. Then bringing the drum to one ear.	"Hello?" when bringing the drum to the ear

Appendix D

Description of levels of behavior and examples of children's behavior at each level.

Level 1: No Pretense

A child does not interact with any objects; or touches, holds, transports, or manipulates an object in an active and attentive manner.

- A girl holds her hand on the xylophone, while talking to her mother.
- A girl places blocks on top of each other, building a tower.
- A boy pulls a red bendy stick on both sides so that it extends, then pushes on both sides so that it contracts.

Level 2: Autosymbolic

A child uses an object in a way that is normally used, but he or she attributes features to the object which are not present, or pretends inanimate objects are animate. The pretend act can be accompanied by sound effects or words explaining the pretend setting.

- A girl uses a sponge to wash the dog stuffed animal (no water present).
- A boy pours imaginary tea from teapot into cup (no tea present).
- A girl brings two puppets with their faces close together, and makes kissing sounds.

Level 3: Object Substitution

A child uses an object as if it is something else. The pretend act can be accompanied by sound effects or words explaining the pretend setting.

- A boy takes a red bendy stick and holds it in the cup while stirring it around in the cup like a spoon.
- A girl holds the blue, snakelike, sponge in one hand and pulls on the cord attached to the sponge with her other hand, while saying, "It is a catapult!"
- A girl takes a puppet and places it near the blocks that are stacked like a house, while saying, "This is the girl's house."